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Homing ability of the common vampire bat (*Desmodus rotundus*)

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Abstract

A total of 446 common vampire bats (*Desmodus rotundus*) was released from their home roosts at distances between 10 and 100 km apart. The homing performance varied between < 10 and 60 km. No bats returned when they were released at a distance of 100 km from their home roost. Male homing performance (23%) was superior to that of females (8%). Conversely, the proportion of females settling down in the release area (76%) was larger than that of males (42%). The data suggest that homing ability is closely related to the terrain area of vampire acquaintance or "familiar area".

Key words: *Desmodus rotundus*, homing ability, sex differences

Introduction

Studies on the homing ability of the common vampire bat (*Desmodus rotundus*) have resulted in contradictory statements. Ruschi (1951) sustains that most of the vampire bats are able to return to their home roost from distances of up to 120 km during the release night. This would indicate that the homing ability of the vampire bat is equal to that of migratory bats from the northern hemisphere (Cockrum 1956; Mueller and Emlen 1957; Davis 1966). Nevertheless, observations made on fewer individuals (Young 1971) and two incidental observations (Schmidt et al. 1971; Greenhall et al. 1983), suggest that vampire bat-homing performance is less efficient.

The aim of this study was to re-investigate homing abilities of the common vampire bat in northern Argentina.

Material and methods

The study was carried out between 1988 and 1992 in cattle-raising ecosystems of the Provinces (States) of Misiones (ca. 27°S, 55°W) and Formosa (ca. 25°S, 60°W) in northern Argentina. In an effort to avoid contributing to the spread of paralytic rabies, trials were made in areas within a radius of more than 300 km where this illness did not occur (Delpietro and Russo 1996; Delpietro et al. 1997).

Bats were captured after noon inside their original home roost using manual nets. They were kept in individual paper bags and transported by car to the release point where they were 1 banded. Then, when there was total darkness they were released by opening the bags and allowing each one to fly at its own volition. The bats were released only on nights free of rain or strong winds and when the moon was hidden over most of the time. In all the trials the release point was located south of the home (with a tolerance 20° E or W) and in similar ecological areas (Fig. 1). We only used adult bats,

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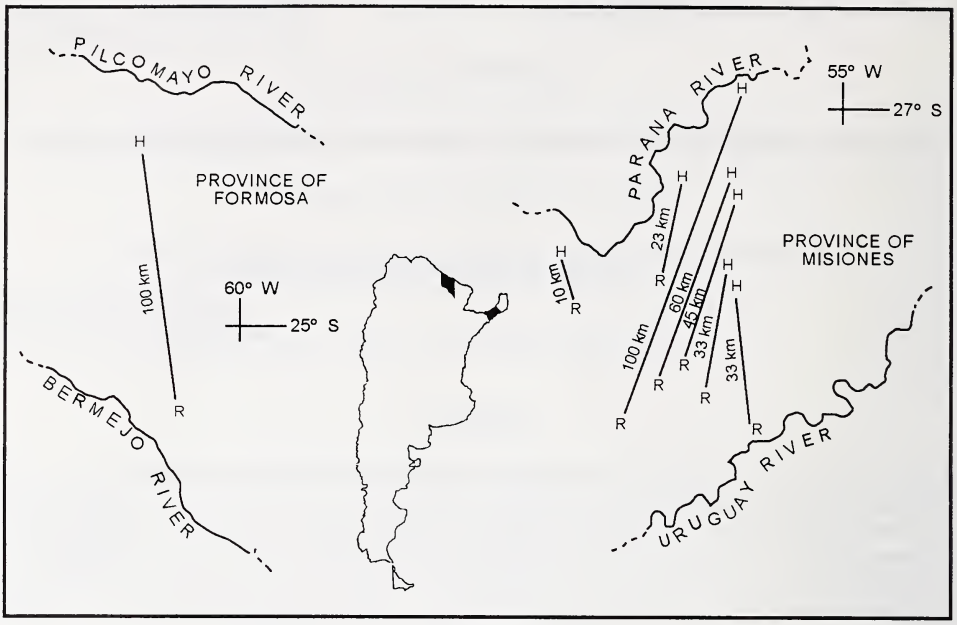

Fig. 1. Homing trials of vampire bats in the provinces of Misiones and Formosa, northern Argentina

but discarding females with a small baby clinging to the nipple and pregnant bats with a palpable fetus larger than 2 cm. A total of 226 males and 240 females was released at different distances ranging between 10 and 100 km (Tab. 1). Nine bats had been banded 7 years before as adults.

Consequently, these individuals were 8 years old when tested (old bats). Mean longevity of vampire bats was estimated to be 2.6 years (Linhart 1973) or 3.4 years (Lord et al. 1976).

In order to obtain information on the vampire bat return time, their home roosts were revisited the day after release (immediate returns), 1 day later (early returns), 1 month later (delayed returns), and 5 to 8 times over a 2 year period (late returns). Also, when we knew the existence of other vampire bat roosts in the home roost area (the roosts located less than 3 km from the original one), we revisited them 4 to 6 times during the 2 years after the release. When we knew the existence of other vampire bat roosts in the release area (the roosts located less than 3 km from the release point), we revisited them 1 month after the release date and 4 to 6 times more over 2 years time. We also registered the bats recaptured far away from the original home roost or the home roost area (strayed bats).

Results

The absolute maximum homing performance was 60 km observed in only 1 of the 69 bats released at that distance. The maximum performance in an immediate return was 33 km. No bats returned when they were released 100 km distance from their home roost (Tab. 1).

A total of 73 bats returned: 71 were recaptured in their home roost and two in the home roost area; male homing performance (23%) was superior to that of females (8%), ($\chi^2 = 14.69$, $p < 0.001$). According to the time of returns, only 8 were immediate (three old bats), 33 early, 21 delayed (one old bat), and 11 late (Tab. 1). The average of immediate returns of the old bats (33%) was higher compared with the entire sample (1.7%) ($\chi^2 = 28.75$, $p \ll 0.001$). In the five trials with home roosts inside the release area we

Table 1. Homing trials of vampire bats in northern Argentina
* = Some were old bat (>8 years)
·· = Two of these were recaptured in the home roost area
NL = No vampire home roost was located.

Release distance km	Males / females						
			Time of return				Abiding in the release area
	Tested	returned	<1day	<2days	<1month	<2years	
10	6/4	5/3	*4/1	1/2	0/0	0/0	1/1
23	18/15	7/4	*2/0	2/2	1/2	2/0	0/5
33	62/36	18/4	0/1*	8/1	5/2	··5/0	21/27
33	54/54	19/8	0/0	12/4	*6/3	1/1	NL
45	13/21	3/1	0/0	0/0	1/1	2/0	NL
60	33/36	1/0	0/0	1/0	0/0	0/0	20/32
100	24/30	0/0	0/0	0/0	0/0	0/0	18/27
100	16/44	0/0	0/0	0/0	0/0	0/0	NL
Total	226/240	53/20	6/2	24/9	13/8	10/1	60/92

tested 143 males and 121 females (Tab. 1). We recaptured 60 males (42%) and 92 females (76%) abiding in the release area ($\chi^2 = 8.33$, $p < 0.01$). These bats were not observed again in their original home roost or in the home roost area. Five strayed bats were recaptured. One male and two females from the 45 km trial were recaptured 2 months after release in a roost 24 km distant from their original home roost and 45° skewed from the straight homeward direction (one of those females continued living >6 years in that roost). Another female belonging to the same trial group was recaptured 5 years after its release in a roost placed 56 km from its home roost and 120° skewed from the straight homeward direction. One male belonging to the 23 km trial group, was recaptured in a cattle-raising field with a mist net 14 months later placed 52 km from their original home roost and 110° skewed from the straight homeward direction. 236 bats were not recaptured at all (lost bats).

Discussion

The data indicate that homing performance of the common vampire bat varies from <10 km up to no returns being recorded at distances 60–100 km. These results slightly surpass those observed by Young (1971), Schmidt et al. (1971), and Greenhall et al. (1983). In general terms, however they may be considered coincident, since smaller differences may result from larger numbers of trials with greater numbers of bats involved. Our data are also similar to those observed in other new world Phyllostomidae, as e. g. the great fruit-eating bat (*Artibeus lituratus*, Lopez-Forment et al. 1971) and the greater spear-nosed bat (*Phyllostomus hastatus*, Williams and Williams 1967, 1970). Very clearly, however, our results differ from those reported by Ruschi (1951).

The decrease in bat returns increasing with release distances, the diversity of homing performance and its sexual difference, the high proportion of bats abiding in the release area, the strayed bats and the lost ones, strongly suggest that homing in the vampire bat is closely related to the terrain of its acquaintance or "familiar area" (Griffo 1961; Davis 1966). This is not surprising when keeping in mind that an adaptive response cannot be expected in this sense. Vampire bats are not migratory animals (Crespo et al. 1961) and under natural conditions they normally are not displaced from the "familiar area". As a

flying animal the bat is safe from floods and only scarcely affected by winds since bats fly near the ground (Dalquest 1955; Villa 1966) and rarely venture far into open areas with no environmental protection (Crespo et al. 1961; Delpietro 1989).

The distances of the immediate returns suggest the maximum extend that the familiar area of the bats can reach, since random returns from these distances during observation time do not appear very likely. On the other hand, the distances of early and delayed returns may point to the fact that some bats may recognize still more extended familiar areas. It is possible that these bats have found a familiar area by scattering radially or wandering at random (Murie 1963; Davis 1966). The late returns and the strayed bats suggest that some of the bats acted that way after being freed.

The diversity of individual vampire bat-homing performance may be related to age (Linhart 1973; Lord et al. 1976), and thus experience as well as learning (Schmidt et al. 1982; Delpietro et al. 1992). Thus, the older bats may have better knowledge of extended "familiar areas" than younger bats.

The higher homing performance of males on average as well as the higher proportion of females settling down in the release area, could indicate that males recognize a larger familiar area than females. Sexual differences in homing performance were observed in other bats (Davis 1966) and in terrestrial mammals (Broadbooks 1970), and this was attributed to the differences in the size of the "familiar area" of each sex. The capacity of the vampire bat to change home range and settle down in the release area can be a selective advantage generated by other situations not related to homing, such as overpopulation, food or refuge shortage, or habitat destruction. In this way, after filling of the Yacireta (ca. 27°30′S, 56°30′W) and Itaipú (ca. 25°30′S, 54°40′W) dams, we observed that the vampires displaced by the flood settled down in the surroundings of the new lakes. This increased the vampire population density in those areas and produced an increase of predation to livestock and the beginning of predation on humans.

The recapture of most of the homed bats in their original home roost confirms previous observations about vampire bat home loyalty (Schmidt et al. 1978; Delpietro et al. 1992).

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Zusammenfassung

Heimfindevermögen des Gemeinen Vampirs (Desmodus rotundus)

Insgesamt wurden 446 Individuen des Gemeinen Vampirs (*Desmodus rotundus*) in 10 bis 100 km Entfernung vom heimatlichen Ruheplatz freigelassen. Das Heimfindeverhalten variierte bei Strecken zwischen 10 und 60 km. Tiere, welche in 100 km Entfernung freigelassen wurden, kehrten nicht zum ursprünglichen Ruheplatz zurück. Das Heimkehrvermögen der männlichen (23% der Tiere kehrten heim) war besser als das bei Weibchen (8%). Andererseits siedelten sich 76% der weiblichen Tiere im Freilassungsgebiet an, doch geschah dies nur bei 42% der Männchen. Die Befunde lassen darauf schließen, daß das Heimfindevermögen in enger Beziehung zur Vertrautheit mit dem Freilassungsgebiet steht.

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